



# Validation of syntaxa names of the class *Quercetea mongolicae* – temperate mainland broadleaved and mixed forests of the Far East

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## ABSTRACT

We validate the name *Quercetea mongolicae* and 56 subordinated syntaxa of broadleaved and mixed forests from the Far East which were published invalidly. We suggest a new taxonomical decision to consider the order *Lespedeza bicoloris–Quercetalia mongolicae* in the class *Quercetea mongolicae* instead of *Quercus mongolicae–Betuletea davuricae* Ermakov 1997.

**Keywords:** syntaxonomy, vegetation, broadleaved forest, mixed forests, *Quercus mongolica*

## РЕЗЮМЕ

Крестов П.В., Дзизюрова В.Д., Корзников К.А. Валидизация названий синтаксонов класса *Quercetea mongolicae* – умеренных широколиственных и смешанных лесов материковой части Дальнего Востока. Мы валидируем название класса *Quercetea mongolicae* и 56 подчиненных ему синтаксонов, объединяющих умеренные широколиственные и смешанные леса Дальнего Востока. Мы предлагаем новое синтаксономическое решение – рассматривать порядок *Lespedeza bicoloris–Quercetalia mongolicae* подчиненным классу *Quercetea mongolicae*, а не *Quercus mongolicae–Betuletea davuricae* Ermakov 1997.

**Ключевые слова:** синтаксономия, растительность, широколиственные леса, смешанные леса, *Quercus mongolica*

Electronic Appendix: [http://www.geobotanica.ru/bp/2023\\_12\\_01/BP\\_2023\\_12\\_1\\_krestov\\_e\\_suppl.xls](http://www.geobotanica.ru/bp/2023_12_01/BP_2023_12_1_krestov_e_suppl.xls)

The phytosociological concept of the class *Quercetea mongolicae* Song ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. and the order *Lespedeza bicoloris–Quercetalia mongolicae* Song ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. was built by Krestov et al. (2006) after Song (1988). The names of these and subordinate syntaxa were published invalidly because the Latin word ‘typus’ was not used for the designation of the type of the names of a syntaxa when the type is chosen among more than one suitable element (articles 3o and 5a of the International Code of the Phytosociological Nomenclature) (Theurillat et al. 2021). We provide the nomenclature corrections and validate the names of the syntaxa.

## Validation of the names

***Quercetea mongolicae* cl. nov.** hoc loco, **holotypus** hoc loco – *Aceri–Quercetalia mongolicae* Takeda, Nakanishi et Choe 1994; the full diagnosis is on pages 108 and 117 in Krestov et al. (2006). **Syn.:** *Quercetea mongolicae* Song 1988 nom. inval. (2b, 5); *Quercetea mongolicae* Song ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1 *Tilio amurensis–Pinetalia koraiensis* ord. nov.** hoc loco, **holotypus** hoc loco – *Tilio amurensis–Pinion koraiensis* (validated in this paper); the full diagnosis is on pages 117–118 in Krestov et al. (2006). **Syn.:** *Tilietalia amurensis* Galkina et Petelin 1990 nom. ined.; *Tilio amurensis–Pinetalia koraiensis* Kim 1992 nom. ined.; *Schisandro–Pinetalia koraiensis* Gumarova 1993 nom. ined.; *Tilio amurensis–Pinion koraiensis* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.1 *Rhododendro daurici–Pinion koraiensis* all. nov.** hoc loco, **holotypus** hoc loco – *Vaccinio vitis-idaeae–Pinetum koraiensis* (validated in this paper); the full diagnosis is on page 118 in Krestov et al. (2006). **Syn.:** *Rhododendro daurici–Pinion koraiensis* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.1.1 *Carici callitrichoi–Pinetum koraiensis* ass. nov.** hoc loco, **holotypus** hoc loco – relevé 1 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 118–119 in Krestov et al. (2006). **Syn.:** *Carici callitrichoi–Pinetum koraiensis* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.1.2 *Vaccinio vitis-idaeae–Pinetum koraiensis* ass. nov.** hoc loco, **holotypus** hoc loco – relevé 2 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 119 in Krestov et al. (2006). **Syn.:** *Vaccinio vitis-idaeae–Pinetum koraiensis* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.2 *Abieti nephrolepidis–Pinion koraiensis* all. nov.** hoc loco, **holotypus** hoc loco – *Diplazio sibirici–Abietetum nephrolepidis* (validated in this paper); the full diagnosis is on page 119 in Krestov et al. (2006). **Syn.:** *Abieti nephrolepidis–Pinion koraiensis* Gumarova 1993 nom. ined., *Abieti nephrolepidis–Pinion koraiensis* Gumarova ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.2.1 *Diplazio sibirici–Abietetum nephrolepidis* ass. nov.** hoc loco, **holotypus** hoc loco – relevé 3 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 119–120 in Krestov et al. (2006). **Syn.:** *Diplazio sibirici–Abietetum nephrolepidis* Gumarova 1993 nom. ined., *Diplazio sibirici–Abietetum nephrolepidis* Gumarova ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.2.2 *Lycopodio annotini–Abietetum nephrolepidis* ass. nov.** hoc loco, **holotypus** hoc loco – relevé 4 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 120 in Krestov et al. (2006). **Syn.:** *Lycopodio annotini–Abietetum nephrolepidis* Gumarova 1993 nom. ined., *Lycopodio annotini–Abietetum nephrolepidis* Gumarova ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

**1.3 *Tilio amurensis–Pinion koraiensis* all. nov.** hoc loco, **holotypus** hoc loco – *Athyrio–Pinetum koraiensis* (validated in this paper); the full diagnosis is on page 121 in Krestov et al. (2006). **Syn.:** *Tilio amurensis–Pinion koraiensis* Kim 1992 nom. ined.; *Tilio amurensis–Pinion koraiensis* Kim ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

1.3.1 *Spiraeo ussuriensis–Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 5 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 121 in Krestov et al. (2006). **Syn.:** *Spiraeo ussuriensis–Quercetum mongolicae* Kim 1992 nom. ined.; *Spiraeo ussuriensis–Quercetum mongolicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.1a *Spiraeo–Quercetum mongolicae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 5 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 121 in Krestov et al. (2006). **Syn.:** *Spiraeo–Quercetum mongolicae typicum* Kim 1992 nom. ined.; *Spiraeo–Quercetum mongolicae typicum* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.1b *Spiraeo–Quercetum mongolicae adenophoretosum tetraphyllae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 6 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 121 in Krestov et al. (2006). **Syn.:** *Spiraeo–Quercetum mongolicae adenophoretosum tetraphyllae* Kim 1992 nom. ined.; *Spiraeo–Quercetum mongolicae adenophoretosum tetraphyllae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.2 *Diplazio sibirici–Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 7 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 121–122 in Krestov et al. (2006). **Syn.:** *Athyrio crenati–Pinetum koraiensis* Kim 1992 nom. ined.; *Athyrio crenati–Pinetum koraiensis* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a). **Comments:** *Athyrium crenatum* (Sommerf.) F. Nyl. is a synonym of *Diplazium sibiricum* (Turcz. ex Kunze) S. Kurata according to the Plants of the World Online (2023).

1.3.2a *Diplazio sibirici–Pinetum koraiensis typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 7 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Athyrio–Pinetum koraiensis athyrietosum multidentati* Kim 1992 nom. ined.; *Athyrio–Pinetum koraiensis athyrietosum multidentati* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.2b *Diplazio sibirici–Pinetum koraiensis rosetosum acicularis* subass. nov. hoc loco, **holotypus** hoc loco – relevé 8 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Athyrio–Pinetum koraiensis rosetosum acicularis* Kim 1992 nom. ined.; *Athyrio–Pinetum koraiensis rosetosum acicularis* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.3 *Tilio amurensis–Betuletum platyphyllae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 9 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Tilio–Betuletum platyphyllae* Kim 1992 nom. ined.; *Tilio–Betuletum platyphyllae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.3a *Tilio amurensis–Betuletum platyphyllae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 9 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Tilio–Betuletum platyphyllae brachybotrietosum paridiformis* Kim 1992 nom. ined.; *Tilio–Betuletum platyphyllae brachybotrietosum paridiformis* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.3.3b *Tilio amurensis–Betuletum platyphyllae abietetosum nephrolepidis* subass. nov. hoc loco, **holotypus** hoc loco – relevé 10 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Tilio–Betuletum platyphyllae abietetosum nephrolepidis* Kim 1992 nom. ined.; *Tilio–Betuletum platyphyllae abietetosum nephrolepidis* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4 *Phrymo asiatica–Pinion koraiensis* all. nov. hoc loco, **holotypus** hoc loco – *Arisaemo amurensis–Pinetum koraiensis* (validated in this paper); the full diagnosis is on page 122 in Krestov et al. (2006). **Syn.:** *Phrymo asiatica–Pinion koraiensis* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.1 *Carici falcatae–Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 11 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 122–123 in Krestov et al. (2006). **Syn.:** *Carici falcatae–Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.1a *Carici falcatae–Pinetum koraiensis typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 11 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 123 in Krestov et al. (2006). **Syn.:** *Carici falcatae–Pinetum koraiensis typicum* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.1b *Carici falcatae–Pinetum koraiensis smilacinetosum davuricae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 12 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 123 in Krestov et al. (2006). **Syn.:** *Carici falcatae–Pinetum koraiensis smilacinetosum davuricae* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.2 *Ulmo japonicae–Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 13 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 123–124 in Krestov et al. (2006). **Syn.:** *Ulmo japonicae–Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.3 *Arisaemo amurensis–Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 14 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 124–125 in Krestov et al. (2006). **Syn.:** *Arisaemo amurensis–Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.3a *Arisaemo amurensis–Pinetum koraiensis typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 14 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 125 in Krestov et al. (2006). **Syn.:** *Arisaemo amurensis–Pinetum koraiensis typicum* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.3b *Arisaemo amurensis–Pinetum koraiensis coniogrammetosum intermediae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 15 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 124–125 in Krestov et al. (2006). **Syn.:** *Arisaemo amurensis–Pinetum koraiensis coniogrammetosum intermediae* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.4.4 *Ribesi maximowicziani–Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 16 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 125 in Krestov et al. (2006). **Syn.:** *Ribesi maximowicziani–Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

1.5 *Carpino cordatae–Abietetum holophyllae* all. nov. hoc loco, **holotypus** hoc loco – *Quercu mongolicae–Abietetum holophyllae* (validated in this paper); the full diagnosis is on pages 125–126 in Krestov et al. (2006). **Syn.:** *Jeffersonio dubiae–Quercion mongolicae* Kim 1992 nom. ined.; *Abieti holophyllae–Carpinion cordatae* Gumarova 1993 nom. ined.; *Jeffersonio dubiae–Quercion mongolicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a). **Comments:** *Jeffersonia dubia* is a synonym of *Plagiorhema dubia*, this species has a low frequency in the alliance (table 3 in Krestov et al., 2006), we decided to select a new name for the alliance.

1.5.1 *Quercu mongolicae–Abietetum holophyllae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 17 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 126–127 in Krestov et al. (2006). **Syn.:** *Abieti holophyllae–Quercetum mongolicae* Kim 1992 nom. ined.; *Abieti holophyllae–Quercetum mongolicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a, 10b). **Comments:** *Abies holophylla* forms an upper canopy layer, this name must be in the second place in the name of syntaxon according to Art.10b of "International Code of Phytosociological Nomenclature" (Theurillat et al. 2021).

1.5.1a *Quercu mongolicae–Abietetum holophyllae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 17 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 126 in Krestov et al. (2006). **Syn.:**

*Abieti holophyllae-Quercetum mongolicae typicum* Kim 1992 nom. ined.; *Campanulo punctatae-Quercetum mongolicae* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Abieti holophyllae-Quercetum mongolicae typicum* Kim ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a, 10b).

1.5.1b *Quercus mongolicae-Abietetum holophyllae acerosum tegmentosae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 18 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 126 in Krestov et al. (2006). **Syn.:** *Abieti holophyllae-Quercetum mongolicae acerosum tegmentosae* Kim 1992 nom. ined.; *Abieti holophyllae-Quercetum mongolicae acerosum tegmentosae* Kim ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a, 10b).

1.5.1c *Quercus mongolicae-Abietetum holophyllae oxalidetosum acetosellae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 19 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 126–127 in Krestov et al. (2006). **Syn.:** *Campanulo punctatae-Quercetum mongolicae oxalidetosum acetosellae* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Abieti holophyllae-Quercetum mongolicae oxalidetosum acetosellae* Gumarova, Prokhorenko et Verkhohat ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a, 10b).

1.5.2 *Polysticho tripterum-Pinetum koraiensis* ass. nov. hoc loco, **holotypus** hoc loco – relevé 20 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 127–128 in Krestov et al. (2006). **Syn.:** *Polysticho subtripterum-Pinetum koraiensis* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Polysticho subtripterum-Pinetum koraiensis* Gumarova, Prokhorenko et Verkhohat ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a). **Comments:** *Polystichum subtripterum* Tzelev is a synonym of *Polystichum tripterum* (Kunze) C. Presl according to according to the Plants of the World Online (2023).

1.5.2a *Polysticho tripterum-Pinetum koraiensis typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 20 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 127–128 in Krestov et al. (2006). **Syn.:** *Polysticho subtripterum-Pinetum koraiensis typicum* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Polysticho subtripterum-Pinetum koraiensis typicum* Gumarova, Prokhorenko et Verkhohat ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

1.5.2b *Polysticho tripterum-Pinetum koraiensis caricetosum revertatae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 21 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 127 in Krestov et al. (2006). **Syn.:** *Polysticho subtripterum-Pinetum koraiensis caricetosum revertatae* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Polysticho subtripterum-Pinetum koraiensis caricetosum revertatae* Gumarova, Prokhorenko et Verkhohat ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

1.5.3 *Fraxino mandshurici-Abietetum holophyllae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 22 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 128 in Krestov et al. (2006). **Syn.:** *Fraxino mandshurici-Abietetum holophyllae* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Fraxino mandshurici-Abietetum holophyllae* Gumarova, Prokhorenko et Verkhohat ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2 *Lespedezo bicoloris-Quercetalia mongolicae* ord. nov. hoc loco, **holotypus** hoc loco – *Dictamno dasycarpi-Quercion mongolicae* (validated in this paper); the full diagnosis is on page 139 in Krestov et al. (2006). **Syn.:** *Lespedezo bicoloris-Quercetalia mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1 *Corylo heterophyllae-Quercion mongolicae* all. nov. hoc loco, **holotypus** hoc loco – *Lycopo lucidi-Quercetum mongolicae* (validated in this paper); the full diagnosis is on pages 139–140 in Krestov et al. (2006). **Syn.:** *Corylo heterophyllae-Quercion mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.1 *Indigofero kirilowii-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 29 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is

on page 140 in Krestov et al. (2006). **Syn.:** *Indigofero kirilowii-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.2 *Meehani urticifoliae-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 30 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 140–141 in Krestov et al. (2006). **Syn.:** *Meehani urticifoliae-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.3 *Gypsophyllo pacificae-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 31 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 141 in Krestov et al. (2006). **Syn.:** *Gypsophyllo pacificae-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.4 *Sophoro flavescens-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 32 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 141–142 in Krestov et al. (2006). **Syn.:** *Sophoro flavescens-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.4a *Sophoro flavescens-Quercetum mongolicae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 32 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 142 in Krestov et al. (2006). **Syn.:** *Sophoro flavescens-Quercetum mongolicae typicum* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.4b *Sophoro flavescens-Quercetum mongolicae arundinellotosum birtae* subass. nov. hoc loco, **holotypus** hoc loco – relevé 33 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 142 in Krestov et al. (2006). **Syn.:** *Sophoro flavescens-Quercetum mongolicae arundinellotosum birtae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.1.5 *Lycopo lucidi-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 34 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 142–143 in Krestov et al. (2006). **Syn.:** *Lycopo lucidi-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2 *Dictamno dasycarpi-Quercion mongolicae* all. nov. hoc loco, **holotypus** hoc loco – *Lespedezo bicoloris-Quercetum mongolicae* (validated in this paper); the full diagnosis is on page 143 in Krestov et al. (2006). **Syn.:** *Dictamno dasycarpi-Quercion mongolicae* Kim 1992 nom. ined.; *Lespedezo-Quercion mongolicae* Gumarova, Prokhorenko et Verkhohat 1994 nom. ined.; *Lespedezo-Quercion mongolicae* Gumarova, Prokhorenko et Verkhohat ex Ermakov 2003 nom. inval. (5a, 17); *Dictamno dasycarpi-Quercion mongolicae* Kim ex Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2.1 *Campanulo glomeratae-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 35 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 143–144 in Krestov et al. (2006). **Syn.:** *Campanulo glomeratae-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2.1a *Campanulo glomeratae-Quercetum mongolicae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 35 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 143–144 in Krestov et al. (2006). **Syn.:** *Campanulo glomeratae-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2.1b *Campanulo glomeratae-Quercetum mongolicae lathyretosum davidii* subass. nov. hoc loco, **holotypus** hoc loco – relevé 36 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 144 in Krestov et al. (2006). **Syn.:** *Campanulo glomeratae-Quercetum mongolicae lathyretosum davidii* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2.2 *Melico nutansi-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 37 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 144 in Krestov et al. (2006). **Syn.:** *Melico nutansi-Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat 2006 nom. inval. (3o, 5a).

2.2.3 *Melampyro setacei-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 38 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 144–145 in Krestov et al. (2006). **Syn.:** *Melampyro setacei-Quercetum mongolicae* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

2.2.4 *Lespedezo bicoloris-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 39 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 144–145 in Krestov et al. (2006). **Syn.:** *Lespedezo bicoloris-Quercetum mongolicae* Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a). **Syn.:** *Lespedezo bicoloris-Quercetum mongolicae* Kim 1992 nom. ined.; *Lathyro humilis-Quercetum mongolicae* Gumarova 1993 nom. ined.; *Artemisio keiskeanae-Quercetum mongolicae* Gumarova, Prokhorenko et Verkholat nom. ined.; *Artemisio keiskeanae-Quercetum mongolicae* Gumarova, Prokhorenko et Verkholat ex Ermakov 2003 nom. rej. (31); *Lespedezo bicoloris-Quercetum mongolicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

2.2.4a *Lespedezo bicoloris-Quercetum mongolicae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 39 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on page 145 in Krestov et al. (2006). **Syn.:** *Lespedezo bicoloris-Quercetum mongolicae ulmetosum japonicae* Kim 1992 nom. ined.; *Lespedezo bicoloris-Quercetum mongolicae ulmetosum japonicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

2.2.4b *Lespedezo bicoloris-Quercetum mongolicae saussuretosum odontolepis* subass. nov. hoc loco, **holotypus** hoc loco – relevé 40 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 145 in Krestov et al. (2006). **Syn.:** *Lespedezo bicoloris-Quercetum mongolicae saussuretosum odontolepis* Kim 1992 nom. ined.; *Lespedezo bicoloris-Quercetum mongolicae saussuretosum odontolepis* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

We also validate the name of the association *Dryopterido crassirhizomae-Quercetum mongolicae* (the alliance *Rhododendro schlippenbachii-Quercion mongolicae* Song ex Takeda, Nakanishi et Choe 1994, the order *Aceri pseudosieboldiani-Quercetalia mongolicae* Song ex Takeda, Nakanishi et Choe 1994).

*Dryopterido crassirhizomae-Quercetum mongolicae* ass. nov. hoc loco, **holotypus** hoc loco – relevé 27 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 131 in Krestov et al. (2006). **Syn.:** *Dryopterido crassirhizomae-Quercetum mongolicae* Kim 1992 nom. ined.; *Dryopterido crassirhizomae-Quercetum mongolicae* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

*Dryopterido crassirhizomae-Quercetum mongolicae typicum* subass. nov. hoc loco, **holotypus** hoc loco – relevé 27 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 131 in Krestov et al. (2006). **Syn.:** *Dryopterido crassirhizomae-Quercetum mongolicae lilietosum distichi* Kim 1992 nom. ined.; *Dryopterido crassirhizomae-Quercetum mongolicae lilietosum distichi* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

*Dryopterido crassirhizomae-Quercetum mongolicae coryletosum thunbergii* subass. nov. hoc loco, **holotypus** hoc loco – relevé 28 in Tables 5 and 6, pages 111–117 in Krestov et al. (2006); the full diagnosis is on pages 131 in Krestov et al. (2006). **Syn.:** *Dryopterido crassirhizomae-Quercetum mongolicae coryletosum thunbergii* Kim 1992 nom. ined.; *Dryopterido crassirhizomae-Quercetum mongolicae coryletosum thunbergii* Kim ex Krestov, Song, Nakamura et Verkholat 2006 nom. inval. (3o, 5a).

### Syntaxonomical position of the order *Lespedezo bicoloris-Quercetalia mongolicae*

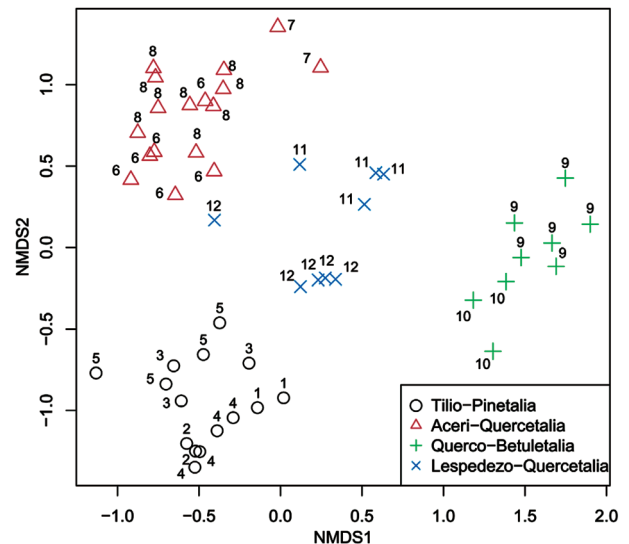
The order *Lespedezo-Quercetalia* was considered in the class *Quercu mongolicae-Betuletea davuricae* Ermakov 1997 (Krestov et al. 2006) (*Q.m.-B.d.*). We reclassified the synoptic table of the classes *Quercetalia mongolicae* (*Q.m.*) and *Q.m.-B.d.* (Table 3 in Krestov et al. 2006) using the modified TWINSPAN classifi-

cation (Roleček et al. 2009) with the numbers of clusters = 4 and built the NMDS ordination diagram using the function metaMDS from the R package “vegan” (Oksanen et al. 2022).

The result of the TWINSPAN analysis shows the stable syntaxonomical structure of the orders *Aceri-Quercetalia*, *Lespedezo-Quercetalia*, *Tilio-Pinetalia* (*Q.m.*) and *Quercu mongolicae-Betuletea davuricae* Ermakov 1997 (*Q.m.-B.d.*). Only two associations, *Indigofero kirilovii-Quercetum mongolicae* and *Meehani urticifoliae-Quercetum mongolicae*, classified into the alliance *Rhododendro-Quercion* from the order *Aceri-Quercetalia* instead of their original position in the alliance *Corylo heterophyllae-Quercion mongolicae* from the order *Lespedezo-Quercetalia*. Both associations unite forests of northeast China.

We found that the order *Lespedezo-Quercetalia* is much closer floristically to the two orders from the class *Q.m.* than to the order *Quercu mongolicae-Betuletea davuricae* Ermakov 1997 from the class *Q.m.-B.d.* There are 33 common species (with the frequency classes III–V) in the orders *Lespedezo-Quercetalia* and *Quercu-Betuletea*; 69 common species in the orders *Aceri-Quercetalia*, *Tilio-Pinetalia* and *Lespedezo-Quercetalia* (see framed synoptic table in Appendix). The species *Acer mono*, *Carex siderosticta*, *Corylus mandshurica*, *Maackia amurensis*, *Rabdosia excisa* and *Tilia amurensis* are common to the orders *Aceri-Quercetalia*, *Tilio-Pinetalia* and *Lespedezo-Quercetalia* and not present in the order *Quercu-Betuletea*. The central species of the class *Q.m.* is *Quercus mongolica*. This species has low frequency in the class *Q.m.-B.d.* while it is most common and abundant species in the class *Q.m.* The floristic similarity of *Lespedezo-Quercetalia* with the orders from the class *Q.m.* is visible in the NMDS diagram (Fig. 1).

Thus, we conclude that the order *Lespedezo-Quercetalia* should be considered in the class *Q.m.*, and two associations,



**Figure 1** The result of the NMDS analysis (half-change axis scores, stress=0.11, number of dimensions=2) of the associations from the classes *Quercetalia mongolicae* and *Quercu mongolicae-Betuletea davuricae*. Numbers indicate the alliances: 1 – *Rhododendro daurici-Pinion koraiensis*; 2 – *Abieti nephrolepidis-Pinion koraiensis*; 3 – *Tilio amurensis-Pinion koraiensis*; 4 – *Phrymo asiaticae-Pinion koraiensis*; 5 – *Carpino cordatae-Abietion holophyllae*; 6 – *Rhododendro schlippenbachii-Quercion mongolicae*; 7 – *Rhododendro mucronulati-Pinion densiflorae*; 8 – *Lindero obtusilobae-Quercion mongolicae*; 9 – *Kitaganio terebinthaceae-Betulion davuricae*; 10 – *Ligulario fischeri-Betulion davuricae*; 11 – *Corylo heterophyllae-Quercion mongolicae*; 12 – *Dictamno dasycarpi-Quercion mongolicae*

*Indigofero kirilowii–Quercetum mongolicae* and *Meehani urticifoliae–Quercetum mongolicae* in another union and order of this class.

## CONCLUSIONS

Thus, the the hierarchical system of lower syntaxa of the class *Quercetea mongolicae*, the temperate broadleaved deciduous and mixed forests from the mainland Far East is as follows. Asterisks\* indicate syntaxa not presented in the Russian Far East.

### Class

#### Order

#### Alliance

#### Association

#### Subassociation

*Quercetea mongolicae* Song ex Krestov, Dzizyurova et Korznikov 2023

*Aceri pseudosieboldiani–Quercetalia mongolicae* Song ex Takeda, Nakanishi et Choe 1994

*Lindero obtusilobae–Quercion mongolicae* Kim 1990\*

*Artemisio keiskeanae–Quercetum mongolicae* Kim 1990\*

*Carpinetum laxiflorae* Kim et Yim 1986\*

*Lindero obtusilobae–Quercetum mongolicae* J.-S. Song, S.D. Song, Park, Seo, Chung, Roh et Kim 1995\*

*Lepedezo maximowiczii–Quercetum serratae* Takeda, Nakanishi et Choe 1994\*

*Meliosmo myrianthae–Quercetum serratae* Kim 1990\*

*Saso borealis–Quercetum mongolicae* Kim 1990\*

*Staphyleo bumaldae–Quercetum serratae* Kim 1990\*

*Synelesio palmatae–Carpinetum laxiflorae* Kolbek et al. 2003\*

*Synelesio palmatae–Quercetum serratae* J.-S. Song, Roh, Chung, S.D. Song, Ohno et Mochida 1999\*

*Rhododendro mucronulati–Pinion densiflorae* Kim et Yim 1986

*Festuco ovinae–Pinetum densiflorae* Song 1992

*Rhododendro mucronulati–Pinetum densiflorae* Kim et Yim 1986\*

*Rhododendro schlippenbachii–Quercion mongolicae* Song ex Takeda, Nakanishi et Choe 1994\*

*Ainsliaeo acerifoliae–Quercetum mongolicae* J.-S. Song, Roh, Chung, S.D. Song, Ohno et Mochida 1999\*

*Dryopterido crassirhizomae–Quercetum mongolicae* Kim ex Krestov, Dzizyurova et Korznikov 2023\*

*Indigofero kirilowii–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023\*

*Lychno cognatae–Quercetum mongolicae* Kim 1990\*

*Meehani urticifoliae–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023\*

*Partenocisio tricuspidati–Fraxinetum rhynchophyllae* Kolbek, Jarolimek et Valachovic in Kolbek, Srutek & Box 2003\*

*Vaccinio koreani–Quercetum mongolicae* Kim 1990\*

*Veronico coreani–Quercetum mongolicae* J.-S. Song, S.D. Song, Park, Seo, Chung, Roh et Kim 1995\*

*Lepedezo bicoloris–Quercetalia mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Corylo heterophyllae–Quercion mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Gypsophyllo pacificae–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Lycopo lucidi–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Sophoro flavescens–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Sophoro flavescens–Quercetum mongolicae typicum* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Sophoro flavescens–Quercetum mongolicae arundinellatosum hirtae* Krestov, Song, Nakamura et

Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Dictamno dasycarpi–Quercion mongolicae* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Campanulo glomeratae–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Campanulo glomeratae–Quercetum mongolicae typicum* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Campanulo glomeratae–Quercetum mongolicae lathyretosum davidii* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Lepedezo bicoloris–Quercetum mongolicae* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Lepedezo bicoloris–Quercetum mongolicae typicum* Krestov, Dzizyurova et Korznikov 2023

*Lepedezo bicoloris–Quercetum mongolicae saussuretosum odontolepis* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Melico nutansi–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Melampyro setacei–Quercetum mongolicae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Tilio amurensis–Pinetalia koraiensis* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Abieti nephrolepidis–Pinion koraiensis* Gumarova ex Krestov, Dzizyurova et Korznikov 2023

*Diplazio sibirici–Abietetum nephrolepidis* Gumarova ex Krestov, Dzizyurova et Korznikov 2023

*Lycopodio annotini–Abietetum nephrolepidis* Gumarova ex Krestov, Dzizyurova et Korznikov 2023

*Carpino cordatae–Abietion holophyllae* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Fraxino mandsburici–Abietetum holophyllae* Gumarova, Prokhorenko, Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Polysticho tripteron–Pinetum koraiensis* Krestov, Dzizyurova et Korznikov 2023

*Polysticho tripteron–Pinetum koraiensis typicum* Krestov, Dzizyurova et Korznikov 2023

*Polysticho tripteron–Pinetum koraiensis caricetosum reventae* Krestov, Dzizyurova et Korznikov 2023

*Quervo mongolicae–Abietetum holophyllae* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Quercu mongolicae–Abietetum holophyllae typicum* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Quercu mongolicae–Abietetum holophyllae aceretosum tegmentosae* Kim ex Krestov, Dzizyurova et Korznikov 2023

*Quercu mongolicae–Abietetum holophyllae oxalidetosum acetosellae* Gumarova, Prokhorenko ex Krestov, Dzizyurova et Korznikov 2023

*Phrymo asiaticae–Pinion koraiensis* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Carici falcatae–Pinetum koraiensis* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Carici falcatae–Pinetum koraiensis typicum* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Carici falcatae–Pinetum koraiensis smilacinetosum davuricae* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Rhododendro daurici–Pinion koraiensis* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Carici callitrichoi–Pinetum koraiensis* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Vaccinio vitis–idaecae–Pinetum koraiensis* Krestov, Song, Nakamura et Verkhohat ex Krestov, Dzizyurova et Korznikov 2023

*Tilio amurensis–Pinion koraiensis* Kim ex Krestov, Dzizyurova et Korznikov 2023

- Diplazio sibirici*–*Pinetum koraiensis* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Diplazio sibirici*–*Pinetum koraiensis typicum* Krestov, Dzizyurova et Korznikov 2023
- Diplazio sibirici*–*Pinetum koraiensis rosetosum acicularis* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Spiraeo ussuriensis*–*Quercetum mongolicae* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Spiraeo*–*Quercetum mongolicae typicum* Krestov, Dzizyurova et Korznikov 2023
- Spiraeo*–*Quercetum mongolicae adenophoretosum tetraphyllae* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Tilio amurensis*–*Betuletum platyphyllae* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Tilio amurensis*–*Betuletum platyphyllae typicum* Krestov, Dzizyurova et Korznikov 2023
- Tilio amurensis*–*Betuletum platyphyllae abietetosum nephrolepidis* Kim ex Krestov, Dzizyurova et Korznikov 2023
- Ulmo japonicae*–*Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat ex Krestov, Dzizyurova et Korznikov 2023
- Arisaemo amurensi*–*Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat ex Krestov, Dzizyurova et Korznikov 2023
- Arisaemo amurensi*–*Pinetum koraiensis typicum* Krestov, Song, Nakamura et Verkholat ex Krestov, Dzizyurova et Korznikov 2023
- Arisaemo amurensi*–*Pinetum koraiensis coniogrammetosum intermediae* Krestov, Song, Nakamura et Verkholat ex Krestov, Dzizyurova et Korznikov 2023
- Ribesi maximowicziani*–*Pinetum koraiensis* Krestov, Song, Nakamura et Verkholat ex Krestov, Dzizyurova et Korznikov 2023

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